(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 810 352 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
11.12.2002 Bulletin 2002/50

(51) Int Cl.[7]: **F01M 13/04**, B01D 39/16

(21) Application number: **97108718.4**

(22) Date of filing: **30.05.1997**

(54) **Purifier device for a bleed circuit of an endothermal engine block and a bleed circuit provided with this device**

Reinigungsvorrichtung für die Kurbelwellenentlüftung einer Brennkraftmaschine und eine Kurbelwellenentlüftung ausgerüstet mit dieser Vorrichtung

Dispositif de récupération pour un circuit d'évacuation des gaz du carter d'un moteur à combustion interne et un circuit d'évacuation équipé de ce dispositif

(84) Designated Contracting States:
CH DE ES FR GB IT LI SE

(30) Priority: **31.05.1996 IT TO960473**

(43) Date of publication of application:
03.12.1997 Bulletin 1997/49

(73) Proprietors:
- **Pall Corporation**
  East Hills, New York 11548 (US)
- **IVECO FIAT S.p.A.**
  10156 Torino (IT)

(72) Inventors:
- **Stella, Angelo**
  20088 Rosate (IT)
- **Rossi, Franco**
  20125 Milano (IT)
- **Dellora, Giancarlo**
  10036 Settimo Torinese (IT)

(74) Representative: **Franzolin, Luigi et al**
STUDIO TORTA S.r.l.,
Via Viotti, 9
10121 Torino (IT)

(56) References cited:
EP-A- 0 506 571
FR-A- 2 263 804
US-A- 4 602 595
US-A- 4 627 406

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 0 810 352 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a purifier device for a bleed circuit of the block of an endothermal engine.

[0002] As is known, the blocks of endothermal engines are provided with a bleed circuit adapted to discharge outside this block the so-called "blow-by" gases, i.e. gases that are drawn down by the cylinders into the block via the piston segments. The bleed is necessary both to prevent an increase of pressure within the block and to offset the volume variations due to the movement of the pistons.

[0003] The blow-by gases contain finely atomised oil particles as well as particles of non-combusted carbon materials (particulates) having dimensions of the order of some μm, typically between 5 and 8 μm.

[0004] The bleed circuit is in this case of the open type, i.e. it discharges the blow-by gases into the atmosphere; in this case the oil and the particulates have to be separated from the gases for obvious reasons of environmental and health protection (the particulates have a carcinogenic effect).

[0005] More frequently, and also for regulatory reasons, the bleed circuit is of the closed type and recirculates the blow-by gases to the engine intake in order to ensure the complete combustion of the particulates. In this case as well, however, the separation of the oil and the particulates raises a problem; the oil and the particulates tend to form resinous sediments on the components through which the gases pass before reaching the cylinders (in particular on the valves and, in the case of turbocharged engines, in the compressor and the intercooler where they greatly reduce the heat exchange), compromising the correct operation of these components. Moreover, in vehicles fitted with catalytic converters, the combustion of any engine oil recirculated to the intake has damaging effects on the catalytic converter and on the lambda probe.

[0006] While purifier devices of various types have therefore been proposed, they all have drawbacks.

[0007] For instance, impact separators are known in which the flow of gas interacts with walls which cause rapid changes of direction of this flow; separators of this type are not, however, very efficient as regards the separation of the particulates, since the average dimensions of the particulates are too small, and are very bulky. The use of filter members of a conventional type has also proved to be unsatisfactory as, while they have a retaining power sufficient to separate out the particulates, the loss of load through the members themselves is in all likelihood undesirably high and, moreover, the members clog up rapidly.

[0008] US-A-4 627 406 discloses a purifier device having the features of the preamble of claim 1. However, such a document does not address the problem of separating particulate from blow-by gases.

[0009] The object of the present invention is to provide a purifier device for a bleed circuit of an endothermal engine block which is free from the drawbacks connected with the known purifier devices described above.

[0010] This object is achieved by the features of the independent claims.

[0011] For a better understanding of the present invention, a preferred embodiment is described below by way of non-limiting example with reference to the accompanying drawings, in which:

Fig. 1 is a diagram illustrating an endothermal engine whose block is provided with a bleed circuit incorporating a purifier device in accordance with the present invention;

Fig. 2 is a diagrammatic section on an enlarged scale of the purifier device of Fig. 1, with one detail further enlarged.

[0012] In Fig. 1, an endothermal engine comprising a head 2 defining a plurality of cylinders 3, a block 4 and a container 5 adapted to contain lubricating oil is shown by 1. The engine 1 comprises an intake circuit 6 comprising, in series with one another, an inlet filter 7 of conventional type, a turbocharge compressor 8 coupled to a turbine (not shown), an intercooler 9 and an intake manifold 10. The circuit 6 is not described in further detail as it is known.

[0013] The block 4 of the engine 1 is also provided with a bleed circuit 14 for the external discharge from this block of the so-called "blow-by" gases, i.e. the gases that are drawn down between the cylinders and the relative pistons (not shown).

[0014] These gases contain particles of finely atomised oil in suspension as well as solid particles (particulates) predominantly of a carbonaceous nature which are formed in part by partially non-combusted combustion products and in part by solid impurities normally contained in the oil. The dimensions of the particulates are typically between 5 and 8 μm.

[0015] The bleed circuit 14 is preferably of the closed type and connects the interior of the block 4 to the intake circuit 6 downstream of the inlet filter 7.

[0016] The bleed circuit 14 comprises a purifier device 15 having an inlet 16 connected by a duct 17 to the block 4 and an outlet 18 connected by a duct 19 to the intake circuit 6.

[0017] According to the present invention, the purifier device 15 comprises a filter member 20 of the coalescence type interposed between the inlet 16 and the outlet 18.

[0018] The filter member 20 is of the type adapted to cause the finely atomised oil particles to agglomerate by coalescence and to remove (but not to filter) the solid particles.

[0019] A filter appropriate for this purpose is formed by a fibrous mass of non-woven synthetic polymer micro-fibres. The fibres are substantially free from fibre-

fibre bonds and are mechanically linked to one another by entanglement or interlacing. The fibrous mass has a substantially constant volume of spaces.

[0020] The fibrous mass is formed by upstream and downstream portions 20a, 20c, formed by fibres whose diameter is greater than that of the fibres forming a central portion 20b between the upstream and the downstream portions. The effect of this arrangement is to produce relatively coarse drainage layers upstream and downstream with an intermediate layer having an absolute retaining power. The absolute retaining power may be between 5 and 70 μm, preferably between 8 and 30 μm and in particular 20 μm. The retaining power is selected such that the particulates are not retained in the fibrous mass.

[0021] It will be appreciated that the fibrous mass may have any convenient structure. Various possibilities are illustrated in GB-A-2 247 849. One possibility is to have the portion with an absolute retaining power forming the upstream surface of the filter and only one coarse layer forming the downstream surface. It would also be possible to vary the structure of the fibrous mass continuously through the thickness of the fibrous mass from a layer with an absolute retaining power at the upstream surface to a coarse layer at the downstream surface.

[0022] Fibrous masses with these structures form a deep filter means with a high resistance to soiling.

[0023] An example of this filter means is marketed by the Pall Corporation under the trade name "PROFILE STAR".

[0024] The fibrous mass may be shaped in various ways. For instance, it may be in the form of a pleated cylinder without a lateral seal. As shown in Fig. 2, however, the fibrous mass may alternatively be formed as a pleated sheet.

[0025] The purifier device 15 has a drainage outlet 24 disposed downstream of the filter member 20 and connected to a lower zone of the block 4 by a duct 25.

[0026] The operation of the bleed circuit 14 and, in particular, the purifier device 15 is as follows.

[0027] The blow-by gases with the oil and particulates in suspension (shown by a black and white arrow) flow through the duct 17 into the purifier device 15. The particles of oil pass into the filter member 20 where they agglomerate by coalescence to form droplets of dimensions sufficient to prevent them from being drawn downstream; the oil therefore drips onto the base of the filter member 20 and is recirculated into the lower zone of the block 4 via the drainage outlet 24 and the duct 25 and then drips into the container 5.

[0028] The oil in suspension may typically enter the purifier device at a rate of some 2-3 g/hour. In a particular experimental configuration of the type described above, the purifier device 15 was fitted with a filter member 20 in the form of a pleated sheet of filter medium having a sheet surface area of 0.1 m^2. In this configuration, an inlet flow of oil into the purifier device 15 of 2 g/hour was observed and the oil flow through the outlet was 0.3 g/hour. In other words, the purifier device removed some 85% of the oil from the blow-by gases - the oil removed then being recirculated into the block 4 via the drainage outlet 24.

[0029] The particulates which would tend, in the absence of oil, to pass through the filter member 20 as mentioned above, are incorporated on the droplets of oil that agglomerate by coalescence in this member and are recirculated into the block together with the oil. The flow of oil and particulates is shown by a black arrow in the Figures.

[0030] The gases stripped of the oil and particulates (white arrow) flow through the outlet 18 of the purifier device 15 and the duct 19 and are recirculated into the intake circuit 6.

[0031] The advantages that can be obtained with the present invention are evident from an examination of the characteristic features of the bleed circuit 14 and, in particular, the purifier device 15 embodied in accordance with the present invention.

[0032] The use of a filter member of coalescent type makes it possible to separate the oil and particulates from the flow of blow-by gases in an efficient way, with particularly small losses of load and very reduced bulk and cost. Moreover, the use of a filter member with an absolute retaining power that allows the passage of the particulates makes it possible to avoid the clogging up of the filter as the particulates do not accumulate in the filter but are removed by the oil.

[0033] It is lastly evident that modifications and variants that do not depart from the scope of the claims may be made to the bleed circuit 14 and the purifier device 15. The circuit 14 may, for instance, be of the open type and communicate with the outside atmosphere. Moreover, the geometry of the filter member 20 may be of any type, for instance a cylindrical cartridge with a radial flow.

Claims

1. A bleed circuit (14) of an endothermal cylinder engine crankcase (4) discharging gases containing oil and particulates in suspension, said circuit (14) comprising a purifier device (15) having an inlet (16) adapted to be connected with the interior of the crankcase (4), an outlet (18) and a filter member (20) interposed between said inlet (16) and outlet (18) and adapted to be traversed by the gases in a given direction of flow, said filter member (20) being a coalescence filter adapted to cause the oil to coalesce,
   characterised in that the filter member (20) has an absolute retaining power such that the particulates can pass through the filter member (20).

2. A circuit as claimed in claim 1, **characterised in that** the filter member (20) has an absolute retaining

power of between 5 and 70 μm and preferably between 8 and 30 μm.

3. A circuit as claimed in claim 2, **characterised in that** the filter member (20) has an absolute retaining power of 30 μm.

4. A circuit as claimed in claim 2 or 3, **characterised in that** the filter member (20) has this absolute retaining power at an upstream surface of the filter member.

5. A circuit as claimed in claim 2 or 3, **characterised in that** the filter member (20) has this absolute retaining power in a central filtration layer with relatively coarser associated drainage layers upstream and downstream.

6. A circuit as claimed in any one of the preceding claims, **characterised in that** it comprises means (19) for connecting the outlet of the filter member (20) to an intake circuit (6) of the engine (1).

7. A circuit as claimed in any one of claims 1 to 6, **characterised in that** the filter member (20) is such that the coalescing oil traps the particulates on the oil that has agglomerated by coalescence in order to remove these particulates.

8. A circuit as claimed in any one of claims 1 to 8, **characterised in that** the filter member (20) is formed by a fibrous mass of non-woven synthetic polymer micro-fibres substantially free from fibre-fibre bonds and mechanically linked to one another by entanglement or interlacing.

9. A circuit as claimed in any one of claims 1 to 8, **characterised in that** the purifier device (15) is adapted to remove at least 85% of the oil from the gases.

10. A blow-by gas purifier device (15) for a bleed circuit (14) of a crankcase (4) of an endothermal cylinder engine (1) comprising an inlet (16) adapted to be connected with the interior of the crankcase (4) and to receive blow-by gases containing oil and particulates in suspension, an outlet (18) and a filter member (20) interposed between said inlet (16) and outlet (18) and adapted to be traversed by the gases in a given direction of flow, said filter member (20) being a coalescence filter adapted to cause the oil to coalesce,
characterised in that the filter member (20) has an absolute retaining power such that the particulates can pass through the filter member (20).

11. A device as claimed in claim 10, **characterised in that** the filter member (20) has an absolute retaining power of between 5 and 70 μm and preferably between 8 and 30 μm.

12. A device as claimed in claim 11, **characterised in that** the filter member (20) has an absolute retaining power of 20 μm.

13. A device as claimed in claim 11 or 12, **characterised in that** the filter member (20) has this absolute retaining power in a central filtration layer with relatively coarser associated drainage layers upstream and downstream.

14. A device as claimed in any one of claims 10 to 12, **characterised in that** the filter member (20) has this absolute retaining power at an upstream surface of the filter member (20).

15. A device as claimed in any one of claims 10 to 14, **characterised in that** the filter member (20) is such that the coalescing oil traps the particulates on the oil that has agglomerated by coalescence in order to remove these particulates.

16. A device as claimed in any one of claims 10 to 15, **characterised in that** the filter member (20) is formed by a fibrous mass of non-woven synthetic polymer micro-fibres substantially free from fibre-fibre bonds and mechanically linked to one another by entanglement or interlacing.

17. A device as claimed in any one of claims 10 to 16, **characterised in that** the purifier device (15) is adapted to remove at least 85% of the oil from the gases.

18. An endothermal cylinder engine (1) including a crankcase (4) and a crankase bleed circuit (14) including a blow-by gas purifier device (15) according to any of claims 10-17.

19. A method of treating blow-by gases discharged from a crankcase (4) of an endothermal cylinder engine (1) and containing oil and particulates in suspension, comprising the step of passing said blow-by gases through a coalescence filter member (20) which causes said oil to coalesce and has a retaining power such that the particulates pass through the filter member (20).

Patentansprüche

1. Entlüftungskreis (14) eines Brennkraftmaschinen-Kurbelgehäuses (4) zum Ausgeben von Gasen, die Öl und Festpartikel in Suspension enthalten, wobei der Kreis (14) eine Reinigungsvorrichtung (15), die einen Einlass (16) besitzt, der zur Verbindung mit dem Inneren des Kurbelgehäuses (4) ausgelegt ist,

und ein Filterelement (20), das zwischen dem Einlass (16) und einem Auslass (18) eingelegt ist und dazu ausgelegt ist, von den Gasen in einer gegebenen Strömungsrichtung durchtreten zu werden, aufweist, wobei das Filterelement (20) ein Koaleszenzfilter ist, der dazu ausgelegt ist, das Öl zur Tropfenbildung zu veranlassen, **dadurch gekennzeichnet, dass** das Filterelement (20) ein derartiges absolutes Rückhaltevermögen besitzt, dass die Partikel durch das Filterelement (20) passieren können.

2. Kreis nach Anspruch 1, **dadurch gekennzeichnet, dass** das Filterelement (20) ein absolutes Rückhaltevermögen zwischen 5 und 70 μm und bevorzugt zwischen 8 und 30 μm besitzt.

3. Kreis nach Anspruch 2, **dadurch gekennzeichnet, dass** das Filterelement (20) ein Rückhaltevermögen von 20 μm besitzt.

4. Kreis nach Anspruch 2 oder 3, **dadurch gekennzeichnet, dass** das Filterelement (20) dieses absolute Rückhaltevermögen in einer stromabwärtsgelegenen Oberfläche des Filterelements besitzt.

5. Kreis nach Anspruch 2 oder 3, **dadurch gekennzeichnet, dass** das Filterelement (20) dieses absolute Rückhaltevermögen in einer zentralen Filterungsschicht besitzt, mit relativ gröberen, zugehörigen Drainageschichten stromaufwärts und stromabwärts.

6. Kreis nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** er eine Einrichtung (19) zum Verbinden des Auslasses des Filterelements (20) mit einem Einlasskreis (6) des Motors (1) aufweist.

7. Kreis nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** das Filterelement (20) derart ist, dass das koaleszierende Öl die Festpartikel in dem Öl, das durch Koaleszenz agglomeriert hat, einfängt, um diese Festpartikel zu entfernen.

8. Kreis nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** das Filterelement (20) durch eine faserige Masse aus non-woven, synthetischen Polymikrofasern gebildet ist, die im wesentlichen frei von Faser-Faser Verbund sind und mechanisch miteinander verbunden sind durch Verschlingen oder Verflechten.

9. Kreis nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** die Reinigungsvorrichtung (15) dazu ausgelegt ist, mindestens 85% des Öls von den Gasen zu entfernen.

10. Reinigungsvorrichtung (15) für durchblasendes Gas für einen Entlüftungskreis (14) eines Kurbelgehäuses (4) einer Brennkraftmaschine (1), umfassend einen Einlass (16), der zur Verbindung mit dem Inneren des Kurbelgehäuses (4) und zum Empfangen durchblasender Gase, die Öl und Festpartikel in Suspension enthalten, ausgelegt ist, einen Auslass (18) und ein Filterelement (20), das zwischen dem Einlass (16) und dem Auslass (18) eingelegt und dazu ausgelegt ist, von den Gasen in einer gegebenen Strömungsrichtung durchtreten zu werden, wobei das Filterelement (20) ein Koaleszenzfilter ist, der dazu ausgelegt ist, das Öl zur Tropfenbildung zu veranlassen, **dadurch gekennzeichnet, dass** das Filterelement (20) ein derartiges absolutes Rückhaltevermögen besitzt, dass die Festpartikel durch das Filterelement (20) passieren können.

11. Vorrichtung nach Anspruch 10, **dadurch gekennzeichnet, dass** das Filterelement (20) ein Rückhaltevermögen zwischen 5 und 70 μm und bevorzugt zwischen 8 und 30 μm besitzt.

12. Vorrichtung nach Anspruch 11, **dadurch gekennzeichnet, dass** das Filterelement (20) ein absolutes Rückhaltevermögen von 20 μm besitzt.

13. Vorrichtung nach Anspruch 11 oder 12, **dadurch gekennzeichnet, dass** das Filterelement (20) dieses absolute Rückhaltevermögen in einer zentralen Filterungsschicht besitzt, mit relativ gröberen zugehörigen Drainageschichten stromaufwärts und stromabwärts.

14. Vorrichtung nach einem der Ansprüche 10 bis 12, **dadurch gekennzeichnet, dass** das Filterelement (20) dieses absolute Rückhaltevermögen in einer stromaufwärts gelegenen Oberfläche des Filterelements (20) besitzt.

15. Vorrichtung nach einem der Ansprüche 10 bis 14, **dadurch gekennzeichnet, dass** das Filterelement (20) derart ist, dass das koaleszierende Öl die Festpartikel in dem Öl, das durch Koaleszenz agglomeriert hat, einfängt, um diese Festpartikel zu entfernen.

16. Vorrichtung nach einem der Ansprüche 10 bis 15, **dadurch gekennzeichnet, dass** das Filterelement (20) durch eine faserige Masse aus non-woven, synthetischen Polymermikrofasern gebildet ist, die im wesentlichen frei sind von Faser-Faser Verbund und mechanisch miteinander durch Verschlingen oder Verflechten verbunden sind.

17. Vorrichtung nach einem der Ansprüche 10 bis 16, **dadurch gekennzeichnet, dass** die Reinigungs-

vorrichtung (15) dazu ausgelegt ist, mindestens 85% des Öls von den Gasen zu entfernen.

18. Brennkraftmaschine (1), umfassend ein Kurbelgehäuse (4) und einen Kurbelgehäuseentlüftungskreis (14), der eine Reinigungsvorrichtung (15) für durchblasendes Gas gemäß einem der Ansprüche 10 bis 17 einschließt.

19. Verfahren zum Behandeln durchblasender Gase, die von einem Kurbelgehäuse (4) einer Brennkraftmaschine (1) ausgegeben werden und Öl und Festpartikel in Suspension enthalten, umfassend den Schritt des Passierens der durchblasenden Gase durch ein Koaleszenzfilterelement (20), welches das Öl veranlasst, Tropfen zu bilden und ein derartiges Rückhaltevermögen besitzt, dass die Festpartikel durch das Filterelement (20) passieren.

Revendications

1. Circuit de purge (14) d'un carter moteur d'un moteur endothermique à cylindres(4) évacuant des gaz contenant de l'huile et des matières particulaires en suspension, ledit circuit (14) comportant un dispositif de purification (15) ayant une entrée (16) adaptée pour être connectée à l'intérieur du carter moteur (4), une sortie (18) et un élément formant filtre (20) interposé entre ladite entrée (16) et ladite sortie (18), et adapté pour être traversé par les gaz dans une direction d'écoulement donnée, ledit élément formant filtre (20) étant un filtre de coalescence adapté pour amener le filtre à mettre en oeuvre une coalescence,

caractérisé en ce que l'élément formant filtre (20) a une puissance de retenue absolue, de telle sorte que les matières particulaires peuvent passer à travers l'élément formant filtre (20).

2. Circuit selon la revendication 1, **caractérisé en ce que** l'élément formant filtre (20) a une puissance de retenue absolue comprise entre 5 et 70μm, et de préférence entre 8 et 30 μm.

3. Circuit selon la revendication 2, **caractérisé en ce que** l'élément formant filtre (20) a une puissance de retenue absolue de 20μm.

4. Circuit selon la revendication 2 ou 3, **caractérisé en ce que** l'élément formant filtre (20) a cette puissance de retenue absolue au niveau d'une surface en amont de l'élément formant filtre.

5. Circuit selon la revendication 2 ou 3, **caractérisé en ce que** l'élément formant filtre (20) a cette puissance de retenue absolue dans une couche de filtrage centrale ayant des couches de drainage associées relativement plus grossières en amont et en aval.

6. Circuit selon l'une des revendications précédentes, **caractérisé en ce qu'**il comporte des moyens (19) pour connecter la sortie de l'élément formant filtre (20) à un circuit d'admission (6) du moteur (1).

7. Circuit selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** l'élément formant filtre (20) est de telle sorte que l'huile de coalescence piège les matières particulaires dans l'huile qui s'est agglomérée par coalescence pour supprimer ces matières particulaires.

8. Circuit selon l'une quelconque des revendications 1 à 7, **caractérisé en ce que** l'élément formant filtre (20) est formé par une masse fibreuse de microfibres polymères synthétiques non-tissées sensiblement sans liaison fibre à fibre, et réunies mécaniquement les unes avec les autres par enchevêtrement ou entrelacement.

9. Circuit selon l'une quelconque des revendications 1 à 8, **caractérisé en ce que** le dispositif de purification (15) est adapté pour enlever au moins 85% de l'huile à partir des gaz.

10. Dispositif de purification de gaz contournant le piston (15) destiné à un circuit de purge (14) d'un carter moteur (4) d'un moteur cylindrique endothermique à cylindres (1) comportant une entrée (16) adaptée pour être connectée à l'intérieur de ce carter moteur (4) et pour recevoir des gaz contournant le piston contenant de l'huile et des matiéres particulaires en suspension, une sortie (18) et un élément formant filtre (20) interposé entre ladite entrée (16) et ladite sortie (18), et adapté pour être traversé par les gaz dans une direction d'écoulement donnée, ledit élément formant filtre (20) étant un filtre de coalescence adapté pour amener l'huile à mettre en oeuvre une coalescence, **caractérisé en ce que** l'élément formant filtre (20) a une puissance de retenue absolue, de telle sorte que les matières particulaires peuvent passer à travers l'élément formant filtre (20).

11. Dispositif selon la revendication 10, **caractérisé en ce que** l'élément formant filtre (20) a une puissance de retenue absolue comprise entre 5 et 70 μm, et de préférence entre 8 et 30 μm.

12. Dispositif selon la revendication 11, **caractérisé en ce que** l'élément formant filtre (20) a une puissance de retenue absolue de 20 μm.

13. Dispositif selon la revendication 11 ou 12, **caractérisé en ce que** l'élément formant filtre (20) a cette

puissance de retenue absolue dans une couche de filtrage centrale ayant des couches de drainage associées relativement grossières en amont et en aval.

14. Dispositif selon l'une quelconque des revendications 10 à 12, **caractérisé en ce que** l'élément formant filtre (20) a cette puissance de retenue absolue au niveau d'une surface en amont de l'élément formant filtre (20).

15. Dispositif selon l'une quelconque des revendications 10 à 14, **caractérisé en ce que** l'élément formant filtre (20) est de telle sorte que l'huile de coalescence piège les matières particulaires dans l'huile qui s'est agglomérée par coalescence, pour enlever ces matières particulaires.

16. Dispositif selon l'une quelconque des revendications 10 à 15, **caractérisé en ce que** l'élément formant filtre (20) est constitué d'une masse fibreuse de micro-fibres polymères synthétiques non-tissées sans liaison fibreuse fibre à fibre, et réunies mécaniquement les unes avec les autres par enchevêtrement ou entrelacement.

17. Dispositif selon l'une quelconque des revendications 10 à 16, **caractérisé en ce que** le dispositif de purification 15 est adapté pour enlever au moins 85% de l'huile à partir des gaz.

18. Moteur cylindrique endothermique à cylindres(1) comportant un carter moteur (4) et un circuit de purge de carter moteur (14) incluant un dispositif de purification de gaz contournant le piston (15) selon l'une quelconque des revendications 10 à 17.

19. Procédé de traitement des gaz contournant le piston évacués à partir d'un carter moteur (4) d'un moteur endothermique à cylindre (1), et contenant de l'huile et des matière particulaires en suspension, comportant l'étape consistant à faire passer les gaz contournant le piston à travers un élément formant filtre de coalescence (20) qui amène ladite huile à mettre en oeuvre une coalescence, et qui a une puissance de retenue telle que les matières particulaires peuvent passer à travers l'élément formant filtre (20).

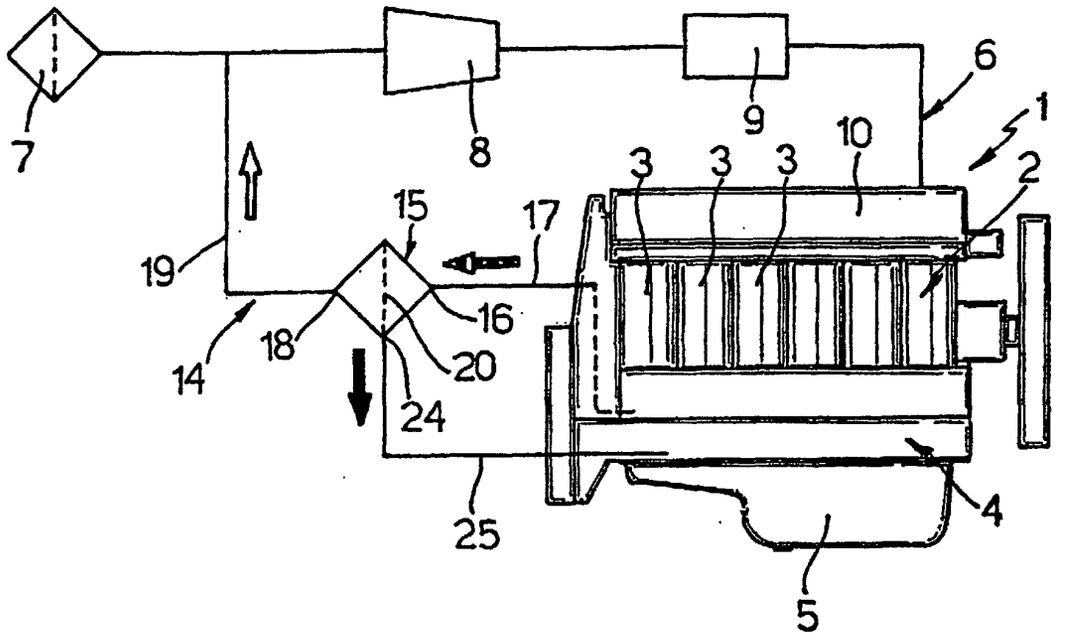
7
8
9
6
1
10
3
3
3
2
15
17
19
16
18
20
14
24
25
4
5

Fig. 1

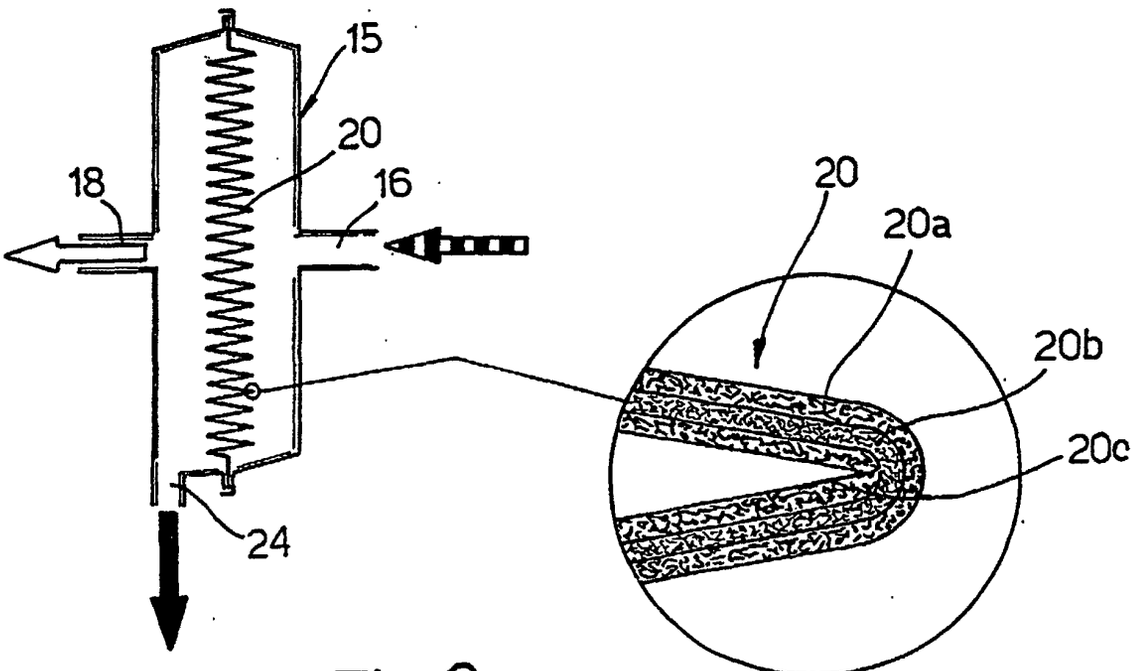
15
20
18
16
24
20
20a
20b
20c

Fig. 2